
**Non-destructive testing — Penetrant
testing —**

**Part 2:
Testing of penetrant materials**

Essais non destructifs — Examen par ressuage —

Partie 2: Essai des produits de ressuage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 135, *Non-destructive testing*, Subcommittee SC 2, and by Technical Committee CEN/TC 138, *Non-destructive testing* in collaboration.

This third edition cancels and replaces the second edition (ISO 3452-2:2006), which has been technically revised.

ISO 3452 consists of the following parts, under the general title *Non-destructive testing — Penetrant testing*:

- *Part 1: General principles*
- *Part 2: Testing of penetrant materials*
- *Part 3: Reference test blocks*
- *Part 4: Equipment*
- *Part 5: Penetrant testing at temperatures higher than 50 °C*
- *Part 6: Penetrant testing at temperatures lower than 10 °C*

The main changes with respects to the previous edition are listed below:

- a) The normative references were updated;
- b) [Tables 1, 4, 8, 9](#) were corrected;
- c) A new [Clause 5.1](#) was inserted;
- d) [Clause 6.6](#) was revised;
- e) The former [Annex B](#) was deleted;
- f) Editorial changes were made.

Non-destructive testing — Penetrant testing —

Part 2: Testing of penetrant materials

SAFETY PRECAUTIONS — The materials required by this part of ISO 3452 include chemicals which may be harmful, flammable and/or volatile. All necessary precautions shall be observed. All relevant International, national and local regulations pertaining to health and safety, environmental requirements, etc. shall be observed.

1 Scope

This part of ISO 3452 specifies the technical requirements and test procedures for penetrant materials for their type testing and batch testing. This part of ISO 3452 covers the temperature range 10 °C to 50 °C. Additional tests in part 5 or part 6 of ISO 3452 may be required outside this range.

On-site control tests and methods are detailed in ISO 3452-1.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3059, *Non-destructive testing — Penetrant testing and magnetic particle testing - Viewing conditions*

ISO 3452-1:2013, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 3452-3, *Non-destructive testing — Penetrant testing — Part 3: Reference test blocks*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 12706, *Non-destructive testing — Penetrant testing — Vocabulary*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12706, ISO 3452-1 and the following apply.

3.1

batch

quantity of material manufactured in one production having uniform properties throughout and with a unique identifying number or mark

3.2

candidate

sample of the testing product submitted for evaluation in accordance with this part of ISO 3452

4 Classification

4.1 Testing products

Penetrant testing products shall be classified by type, method and form in accordance with [Table 1](#).

Table 1 — Testing products

Penetrant		Excess penetrant remover		Developer	
Type	Denomination	Method	Denomination	Form	Denomination
I	Fluorescent penetrant	A	Water	a	Dry
II	Colour contrast penetrant	B	Lipophilic emulsifier	b	Water soluble
				c	Water suspendable
III	Dual-purpose (fluorescent colour contrast penetrant)	C	Solvent (liquid): Class 1 Halogenated Class 2 Non-halogenated Class 3 Special application	d	Solvent-based (non-aqueous for Type I)
				e	Solvent-based (non-aqueous for Types II and III)
		D	Hydrophilic emulsifier	e	Solvent-based (non-aqueous for Types II and III)
		E ^a	Water and solvent removable	f	Special application

^a Method E relates to application. Penetrant material qualified for method A are also considered qualified for method E.

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4.2 Sensitivity levels

4.2.1 General

Sensitivity levels shall be defined separately for penetrant, excess penetrant remover and developer, and for product families. Sensitivity levels of the different types of penetrants are not comparable.

4.2.2 Fluorescent product family

Sensitivity levels for this product family shall be defined by reference products:

- sensitivity level 1/2 (very low);
- sensitivity level 1 (low);
- sensitivity level 2 (medium);
- sensitivity level 3 (high);
- sensitivity level 4 (ultra-high).

Sensitivity level 1/2 applies to Type I method A only.

4.2.3 Colour contrast product family

Sensitivity levels for this product family shall be defined using the type 1 reference block in accordance with ISO 3452-3:

- sensitivity level 1 (normal);

— sensitivity level 2 (high).

4.2.4 Dual-purpose product family

There are no sensitivity levels for dual-purpose penetrants when used as a fluorescent system. However these products may be classified as colour contrast products (see [4.2.3](#)).

5 Testing of penetrant materials

5.1 Personnel

Testing shall be carried out by proficient, suitably trained and qualified personnel and, where applicable, shall be supervised by competent personnel nominated by the employer or, by delegation of the employer, the inspection company in charge of testing. To demonstrate appropriate proficiency it is recommended that personnel be trained according to ISO 9712 or an equivalent formalized system. Operating authorization for personnel shall be issued by the employer in accordance with a written procedure. Non-destructive Testing (NDT) operations, unless otherwise agreed, shall be authorized by a competent and qualified NDT supervisory individual (Level 3 or equivalent) approved by the employer.

5.2 Testing facilities

5.2.1 Type testing

Type testing shall be carried out on penetrant materials according to ISO 3452-1 with exceptions as defined in this part of ISO 3452 to ensure their conformance to the requirements of this part of ISO 3452.

Type testing shall be carried out by a laboratory accredited in accordance with ISO/IEC 17025 for type testing of penetrant materials.

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5.2.2 Batch testing

Batch testing to the requirements of this part of ISO 3452 shall be carried out on each production batch according to ISO 3452-1 to ensure the batch has the same properties as the corresponding type approval sample. In the case of penetrant material packed in spray cans, the content of sulfur and halogens shall be additionally determined according to [6.12](#).

Batch testing shall be carried out under a defined and maintained quality system. A system meeting the requirements of ISO 9001 is considered suitable.

5.2.3 Process and control testing

Process and control tests to monitor the implementation of the method are described in ISO 3452-1:2013, Annex B.

5.3 Reporting

5.3.1 Type testing

The testing laboratory (see [5.2.1](#)) shall provide a certificate of compliance with this part of ISO 3452 and a report that details the results obtained.

If any changes are made to the penetrant material composition, then a new type test and product identity shall be required.

5.3.2 Batch testing

Manufacturers of penetrant materials shall provide certificates of compliance with this part of ISO 3452 (for example, see EN 10204 or ISO 10474).

5.4 Tests

5.4.1 Penetrants

Type and batch testing of penetrant properties shall be carried out in accordance with [Table 2](#).

Table 2 — Properties of penetrants and required tests

Property	Test type	Reference
Appearance	Batch	6.1
Sensitivity	Type and batch	6.2
Density	Type and batch	6.3
Viscosity	Type and batch	6.4
Flashpoint	Type and batch	6.5
Washability (Method A penetrants only)	Batch	6.6
Fluorescent brightness (Type I penetrants)	Type and batch	6.7
UV stability (Type I penetrants)	Type	6.8
Thermal stability (Type I penetrants)	Type	6.9
Water tolerance (Method A penetrants only)	Type	6.10
Corrosive properties	Type and batch	6.11
Content of sulfur and halogens ^a	Type and batch	6.12
Water content (Methods A and E)	Batch	6.20

^a Only required for products designated “low in sulfur and halogens”.

5.4.2 Excess penetrant removers (excluding method A)

Type and batch testing of penetrant remover properties shall be carried out in accordance with [Table 3](#).

Table 3 — Properties of excess penetrant removers and required tests

Property	Test type	Reference
Appearance	Batch	6.1
Sensitivity	Type and batch	6.2
Density	Type and batch	6.3
Viscosity (for Methods B and D only)	Type and batch	6.4
Flashpoint	Type and batch	6.5
Water tolerance (Method B only)	Type and batch	6.10
Corrosive properties	Type and batch	6.11
Content of sulfur and halogens ^a	Type and batch	6.12
Residue on evaporation/solid content (Method C only)	Type and batch	6.13
Penetrant tolerance (Methods B and D only)	Type	6.14

^a Only required for products designated “low in sulfur and halogens”.

Table 3 (continued)

Property	Test type	Reference
Water content (Method B only)	Batch	6.20
Other contaminants on request (as required)	Batch	
a Only required for products designated "low in sulfur and halogens".		

5.4.3 Developers

Type and batch testing of developer properties shall be carried out in accordance with [Table 4](#).

Table 4 — Properties of developers and required tests

Property	Form						Test type	Reference
	a	b	c	d	e	f		
Appearance	x	x	x	x	x	x	Batch	6.1
Sensitivity	x	x	x	x	x	x	Type and batch	6.2
Flashpoint				x	x	x ^b	Type and batch	6.5
Corrosive properties		x	x	x	x	x	Type and batch	6.11
Content of sulfur and halogens ^a	x	x	x	x	x	x	Type and batch	6.12
Solid content				x	x	x ^b	Type and batch	6.13
Developer performance	x	x	x	x		x	Type and batch	6.15
Re-dispersability			x	x	x	x ^b	Type and batch	6.16
Density (of carrier liquid)				x	x	x ^b	Type and batch	6.17
Particle size distribution	x	x	x	x	x	x ^b	Type	6.19
Other contaminants on request (as required)	x	x	x	x	x	x	Batch	
a Only required for products designated "low in sulphur and halogens".								
b If applicable.								

5.4.4 Batch tests for spray cans

Batch testing shall be carried out in accordance with the product performance test given in [6.18](#).

The first and last containers and a container from the middle of the batch shall be tested. Where testing for content of sulfur and halogens in accordance with [6.12](#), only the first container need be tested.

6 Test methods and requirements

6.1 Appearance

The appearance of the sample shall be the same as that of the type test sample.

6.2 Penetrant system sensitivity

6.2.1 Fluorescent penetrants (Type I)

6.2.1.1 Qualification provisions

6.2.1.1.1 Penetrants (Type I)

Method A (water washable) penetrants and Methods B and D (post-emulsifiable) penetrants/emulsifiers shall be qualified with the appropriate reference dry developer D-1. Method C penetrants shall be qualified either on the basis of their performance as Method A, B, or D materials, or, alternatively, with the appropriate reference remover R-1 and reference dry developer D-1 (see [Table 5](#)).

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Table 5 — Reference material designation

Reference material	Designation	
	Method A	Methods B, C and D
Penetrant, Type I, Level 1/2	FP-1/2	
Penetrant, Type I, Level 1	FP-1W	FP-1PE
Penetrant, Type I, Level 2	FP-2W	FP-2PE
Penetrant, Type I, Level 3	FP-3W	FP-3PE
Penetrant, Type I, Level 4	FP-4W	FP-4PE
Penetrant, Type II, Level 1	VP-1W	VP-1PE
Penetrant, Type II, Level 2	VP-2W	VP-2PE
Emulsifier, Type I, Method B		FE-B
Emulsifier, Type I, Method D		FE-D
Emulsifier, Type II, Method B		VE-B
Removers, Class 1, Method C	R-1	R-1
Removers, Class 2, Method C	R-2	R-2
Developer, Form a	D-1	D-1
Developer, Form e	D-2	D-2
FP fluorescent penetrant W water-washable PE post emulsifiable FE emulsifier for fluorescent penetrant VP visible penetrant VE emulsifier for visible penetrant		

6.2.1.1.2 Developers

All developers, except Form f (specific application), intended for use with Type I (fluorescent) penetrant materials, shall be qualified with the reference level 4, Method B penetrant/emulsifier system FP-4PE/FE-B (see Table 6). Form f developers shall be qualified in accordance with 6.2.1.1.4.

A reference sample of each product shall be retained for comparison purposes and designated in accordance with Tables 5 and 6. The manufacturer, manufacturer's reference and the batch number shall be recorded.

NOTE A list of reference products is available from qualified laboratories (e.g. MPA-Hannover, Germany).

6.2.1.1.3 Solvent removers

Classes 1 and 2 solvent removers shall be qualified with reference penetrant FP-4PE and reference developer D-1. Class 3 solvent remover shall be qualified in accordance with 6.2.1.1.4.

6.2.1.1.4 Specific application — Developer/removers

Form f developers and Class 3 removers shall be qualified with materials as specified by the manufacturer and approval shall be specific to those materials.

6.2.1.1.5 Product family

While individual testing products are to be qualified, product families as defined by the manufacturer may be specified as meeting the requirements defined in this part of ISO 3452 (e.g. Type I, Level 2, Method D, Form a).

6.2.1.2 Sensitivity

6.2.1.2.1 General

Sensitivity of type I penetrant systems shall be determined by comparing results of candidate materials, and standard reference products using a set of test panels.

6.2.1.2.2 Test panels

A suitable test panel should be used, e. g. a type 1 reference block, see ISO 3452-3.

Test panels according to ISO 3452-3 have chromium-nickel plating with thicknesses of 10 µm, 20 µm, 30 µm and 50 µm. For each thickness there is a pair of panels with similar cracks. The test panels should be used either for fluorescent or for colour contrast penetrants. The same panels should not be used for the two systems.

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